

The first half of the 20th century was marked by extraordinary progress in medical science and its application to public health. In the U.S., average life span rose from 47 years in 1900 to 68 in 1950 (now having reached 76). Marred most grievously by the great influenza pandemic of 1918, the misnamed "Spanish flu", which claimed 20 million or more lives worldwide, most of the early improvement is credited to the abatement of infectious disease. This followed on the heels of the great discoveries of Louis Pasteur and Robert Koch, the legendary Microbe-Hunters of the 19th Century. Their new insights into germs as agents of disease opened the door to the development of vaccines and antibiotics; equally important were hygienic measures like clean hands, properly washed, refrigerated and cooked food, pasteurized milk, protected water supplies, and general improvements in housing and nutrition.

By the mid-1950's, the new polio vaccines and antibiotic wonder-drugs fostered a sense of triumphalism, echoed in many books and official pronouncements: the human race had conquered the microbes. Medical science now had to face the challenges of degenerative diseases, both those intrinsic to the human frame, and those aggravated by chemical pollution. Heart disease and cancer ascended to the priority rank of mortal ills, and depression and other psychiatric disorders as major sources of morbidity. Life style rather than sanitation became a greater preoccupation: physical fitness meant exercise rather than soap and water. By 1980, the World Health Organization could announce the global eradication of smallpox. This was certainly a historic high-point in international collaboration for a humanitarian objective; and it would also save billions in the future expense of prophylactic vaccination. But this was also the very brink of recognition of a peculiar new form of immunodeficiency disease that appeared to cluster in groups of homosexual men: HIV-AIDS had burst on the scene. It took some time before this was recognized as a newly minted form of infection. Only the happenstance that other retroviruses had long been studied as laboratory curiosities, inducing sarcoma cancers in fowl, accelerated the recognition of the HIV as a new retrovirus. It also accounts for the fact that much the important early work on HIV was done at the National Cancer Institute in Bethesda, Maryland.

Since 1981, HIV has established itself in every corner of the world, and the end is hardly in sight for the devastation it has wreaked. Vaccines are still a distant vision; the innovative protease inhibitor drugs offer a welcome respite, but unlikely a permanent cure as resistant strains of HIV already begin to emerge. While this technological race proceeds, other strains of HIV are emerging in southeast Asia that appear to be more competent in heterosexual transmission, and more likely to break out of the established high risk groups. But with all the anguish and notoriety associated with HIV, it is hardly the worst killer: pride of place round the world goes to tuberculosis and mosquito-borne malaria. We are accustomed to think of these as relics of the poverty of the third world, but drug resistance is becoming a major problem in the management of these diseases, for poor indigenous and affluent travellers alike. Aircraft cabins have already been designated as hazardous vessels for the transmission of tuberculosis; we hardly dare examine the air of crowded public places, subways, terminals. I am not aware that this is ever monitored, and unlike the aircraft these encounters are not going to be remembered.

The last two decades have seen the discovery of more than a score of brand new infectious diseases -- new that is to scientific awareness. It takes a textbook to enumerate them, but a

sample would include:

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Viruses                                     Bacteria and protozoa
Rotavirus                                 Vibrio cholerae O139
Ebola virus                             Cryptosporidium
Hantaan virus (renal syndrome)          Legionella
HTLV-I (leukemia)                       Campylobacter jejuni
Human herpes-virus-6,7,8                Staphylococcal - toxic shock
Hepatitis C, E                          Escherichia coli O157:H7
Parvovirus B19 (anemia)                  Borrelia burgdorferi (Lyme)
Guanarito (hemorrhagic fever)            Ehrlichia (tick-borne)
Sin Nombre hantavirus (pulmonary)        Helicobacter pylori (ulcer)
HIV                                       Cyclospora
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Most of these are probably old neighbors, and what is new is our recognition of their prevalence, often on account of fierce outbreaks. In addition should be numbered the new emergence of antibiotic- resistant strains of any number of pathogens: the ones of greatest consequence today are probably multiple-drug-resistant pneumonia, staphylococci, tuberculosis and malaria.

In addition, we have resurgence of old familiars like dengue, meningitis, yellow fever, plague, cholera and diphtheria, with outbreaks in various parts of the world, mostly associated with the breakdown of public health precautions.

What is going on? What does it portend? What is to be done?

The microbes have proven to be a moving target, incessant in their own genetic evolution, adept at finding niches in our own armor while we complacently sleep. Their genetic plasticity is awesome, mainly on account of the immensity of their cell populations. A single afflicted victim may easily harbor billions if not trillions of infective particles, all subject to Darwinian selection for the most adept genetic variants. They possess mechanisms of genic flexibility and cross-breeding that stagger the imagination, and their generation time is measured in minutes. It has been ever thus: we should recall that most animal species undergo periodic fluctuations owing to disease that may well wipe out a quarter of the cohort. We have suffered this ourselves in ancient history, but have lately been accustomed to a sense of invulnerability shattered by new realities. While our technology offers many wonderful remedies, and promises many more, technology has also given us the jet airplane, stratified economic affluence and a burgeoning world population, all eagerly accepted by the microbes as major allies to their program of feeding on us.

The simple key to our security is the recognition that the human species has an indivisible common cause in defense against the microbial hordes. If we will but apply our technology worldwide to surveillance, immunization, the development, prudent use and dissemination of new antibiotics, and the promotion of health-saving behavior, our wits can go a long way to matching the machinations of their constantly evolving genes.

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